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VOICES FROM THE FIELD

Problem-Based Teacher-Mentor Education: Fostering Literacy Acquisition in Multicultural Classrooms

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Abstract

We designed a professional development (PD) teacher-mentor program that used problem-based learning (PBL) to accomplish two goals. First, teachers explored how PBL could be used effectively in their classrooms to change the way they think about teaching to include literacy development in content areas. Second, PBL was the basis for PD training to help them improve their own knowledge of PBL, become mentors to other teachers, and implement PBL in their schools across content areas.

Educators in the United States are challenged to teach linguistically and culturally diverse (LCD) students with differing literacy levels. The demographics of U.S. classrooms require a rigorous attempt to engage LCD students through collaborative, active learning opportunities (McGroarty, 1998; U.S. Department of Education, 2015). Research shows that literacy learning for all students improves in classroom settings that take a cooperative, student-centered approach (McGroarty, 1988, 1989; NCSS, 1991; Shumway, Saunders, Stewardson, & Reeve, 2001). PBL provides opportunities for students to engage in active learning and allows students with multiple learning styles to negotiate contextualized meaning through a variety of collaborative tasks. PBL has also been shown to be an effective method for teaching learners to be self-directed problem-solvers. However, in the absence of PD and ongoing support, teachers are often resistant to the implementation of PBL.

In our program, we used PBL to help teachers learn more about literacy and PBL while providing opportunities for PD and support. As a result, the teacher reflections, discussions, presentations, and self-evaluations demonstrated how, by using PBL in their classrooms while immersing themselves in evidence-based content, they observed enhanced student collaboration. Teachers felt that they were better able to foster a learning environment in their classrooms that would allow students to develop literacy skills in a content-rich context both because of the incorporation of PBL and because of the support they provided for each other. This idea can be easily adapted to foster teacher development and mentoring programs in other fields.

Keywords: problem-based learning, literacy acquisition, teacher education, teacher training

Introduction and Background

Urban educators in multicultural settings frequently feel strained to develop meaningful and effective literacy education that meets the needs of all their students. The dearth of effective literacy materials and training is felt most acutely in secondary schools because, by that point, literacy is largely assumed and the pedagogical focus shifts more toward perceived academic preparation.

Additionally, secondary school teachers must create activities that help keep students motivated, particularly since research shows that students tend to lose motivation once they leave primary school (Wigfield, Eccles, Schiefele, Roseser, & Davis-Kean, 2006 in Van Loon, Ros, & Martens, 2013). Problem-based learning (PBL) provides options for meeting the needs of all students, including those from linguistically and culturally diverse (LCD) backgrounds. However, while teachers may understand the value of using PBL, it is

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especially challenging to implement at the secondary level due to the lack of experiential and pragmatic teacher training.

An increasing body of research indicates that one-and-done PD is less effective in promoting meaningful classroom change, and that without support, implementing PBL can be a challenge (Van Loon et al., 2013). In a PD program focused on helping teachers implement PBL, without ongoing training and coaching teachers often are limited in their ability to implement anything but very basic aspects. The goal of this project was to create a teacher-mentoring program using PBL to teach teachers how to effectively implement PBL in their classrooms to better foster environments that promote literacy acquisition in content areas.

Problem-Based Learning

PBL is a student-centered teaching methodology that begins with an authentic, engaging problem that does not have a clear, correct answer (see, for example, Barrows & Tamblyn, 1980; Savery & Duffy, 1998). Students work together to investigate the problem, actively gaining knowledge and skills in critical thinking, problem solving, and information literacy while meeting course content standards. PBL helps instructors foster an environment in which all students can be more engaged in the acquisition of knowledge, more motivated to learn content, and, ostensibly, better able to transfer those skills to authentic contexts that also do not have clear, correct answers. With PBL, the instructor does not lecture or provide the answer. Instead, the students use inquiry-based strategies to assess their current knowledge about the problem, identify any gaps, and then decide on a plan to fill in that missing information. PBL has been successfully used in many disciplines, levels, and environments (see, for example, Barrows & Tamblyn, 1980; Savery, 2006; Savery & Duffy, 1998; Torp & Sage, 2002); however, there is little written about how PBL has been used to help disadvantaged students in secondary schools (Gallagher & Gallagher, 2013).

Integrating PBL into the secondary curriculum is challenging because of the need to train the instructors to keep the momentum going beyond the first attempt at implementation (Van Loon et al., 2013; Wiek, Xiong, Brundiers, & van der Leeuw, 2013). Teachers have difficulty creating the right types of problems and the right environment, especially when they do not fully believe that PBL will help their teaching (Van Loon et al., 2013). They also need to be prepared for resistance and reticence from students during implementation of PBL. Students may be reluctant to engage in more active work and contextual thinking, so the teachers need to be prepared to respond. In addition, because teachers are trained to meet specific standards and to create activities to demonstrate that students have met each standard, many teachers tend to organize content linearly rather than contextually and often question student motivation and commitment to the work. The biggest shift in PBL is that teachers must create an environment in which students have to use the knowledge reflected in the standards to solve a problem, but that type of thinking requires a driving question and multiple points of input, so if the teacher has not completely developed a deep understanding and commitment to PBL, the effort is likely to fail. Even if the teacher has this deep understanding and commitment, it takes time to develop the skills and patience to effectively implement PBL.

In order for there to be meaningful implementation of PBL methods in the classroom, teachers must change their previous beliefs about classroom settings and teacher behaviors (Clarke & Hollingsworth, 2012 in Van Loon et al., 2013), spend time over a sustained period to "develop absorb, discuss, and practice new knowledge" (Garet, Porter, Desimone, Birman, & Yoon, 2001 and Guskey, 2000 in Van Loon et al., 2013, p. 413), and collaborate with others who are actively practicing PBL in the same setting (Garet et al., 2001 in Van Loon et al., 2013).

Teaching in Multicultural Classrooms

In order to foster equal literacy opportunities for all students in multicultural classrooms, teachers must include "culturally and linguistically fair, appropriate, and success-promoting materials, pedagogy, and placement options" (Roseberry-McKibben, 2002, p. 2). Research has shown that PBL fosters an environment for success. Gallagher and Gallagher (2013) found that because of the high level of engagement required by PBL, students paid less attention to how hard they were working, and they were able to spend more time thinking. In addition, teachers who implemented PBL opportunities learned to see academic potential in students they may not have seen it in previously (Gallagher & Gallagher, 2013).

Many teacher educators and researchers have argued for more authentic PBL literacy instruction, but there are a number of key barriers blocking the use of this progressive methodology. The first barrier is a lack of ongoing academic and experiential preparation for teachers (Rosa-Lugo & Fradd, 2000). This preparation should include training in progressive theories of methodology, including PBL and literacy learning strategies, which involve active learning, student inquiry, and assessments that are more authentic. Second, there is a particularly acute lack of appropriate materials and pedagogical methods for educating students from these diverse backgrounds at the secondary level (Goldstein, 2000; Roseberry-McKibbin, 2001). Finally, schools often lack interdisciplinary communication and cooperation. Research has shown that using "evidence-informed collaborative inquiry" for teacher PD has a positive impact on student learning (Sinnema, Sewell, & Milligan, 2011, p. 247).

Evidence-informed teaching research occurs when teachers use their classrooms for research; collaboration occurs when teachers work with other researcher-teachers to inform their teaching. This recursive feedback process creates more effective outcomes (Sinnema et al., 2011). Therefore, using PBL as the frame, we developed a collaborative PD program based on best practices (Van Loon et al., 2013) to better prepare teachers to incorporate literacy skills in their content teaching by advancing their own PBL skills, using PBL in their classrooms, and sharing the results to help each other improve continuously.

Literacy Problems in Education

By adulthood, most students in the United States will be participating in an increasingly diverse society and functioning within an increasingly interdependent international world. To compensate for this diversity, many educational fields have focused on how to teach literacy to these multicultural populations. In fact, a large portion of the research in these areas begins first by defining each group and delineating their differences from other groups of students. Additionally, literacy pedagogy that has been developed for teaching various groups of students is frequently taught to teachers as isolated information, even though these strategies may be useful in teaching numerous groups of students. For instance, teaching strategies used by educators focusing specifically on linguistic differences often work not only with English language learners (ELLs) and with bilingual students, but also with other at-risk students.

In addition to multiple groups of students benefiting from literacy instruction, many classroom researchers have found that groups of students with varying backgrounds and ability levels frequently benefit from problem-based collaborative work, especially in the acquisition of literacy (Donahue, 1999). Researchers have shown that literacy learning for all students improves in classroom settings that take a cooperative, student-centered approach as opposed to those with a competitive, individualistic approach (McGroarty, 1988, 1989; NCSS, 1991; Shumway et al., 2001). When teachers use PBL in their classrooms, they provide opportunities for students to engage in active learning and multilevel processing and the use of multiple learning styles to negotiate contextualized meaning through a variety of collaborative tasks. The state of the demographics of U.S. classrooms requires a rigorous attempt to engage LCD students in mainstream classrooms (McGroarty, 1998; U.S. Department of Education, 2015). Based on these issues, a systematic effort to implement problem-based learning methodologies and a sustained training for all teachers, especially those in content areas, will benefit both teachers and students.

Program Design

In an effort to increase the quality of content-area literacy instruction in two multicultural urban school districts, we designed a collaborative, two-year, grant-funded, problem-based teacher-mentor training program. Teachers in each cohort for both years of the project came from secondary schools in multicultural districts. In District A, teachers represented seven urban schools with a student population of 22% white, 50% black, 23% Hispanic, 5% other. In District B, teachers came from six urban schools that were 70% white, 20% black, 2% Hispanic, and 9% other.

During the first year, the program addressed the issue of the lack of experiential preparation, as mentioned above, by offering practicing teachers from multiple disciplines the opportunity to both learn about and practice PBL. This process included the teachers forming a community of co-learners/mentors across disciplines who collaborated to provide continual feedback. Second, the program gave the teachers a wealth of resources to use to create appropriate materials, time to use those materials in their classrooms, and a support system for asking questions and reporting back about how the implementation went. Finally, the program provided the teachers the opportunity to collaborate and communicate with teachers and university facilitators. The project focused on three major objectives:

1. To develop a teacher-mentor PD program.
2. To develop PBL and literacy curricula and pedagogy that could better meet the needs of all students in multicultural classrooms.
3. To encourage interdisciplinary communication and collaboration across content areas, schools, and levels of instruction.

The two school systems participating in the program indicated that they had been working on the above-mentioned literacy issues in their districts and wanted to be involved in our two-year, cross-curricular PBL teacher-mentor training program. We formed an integrated, multidisciplinary team consisting of middle and secondary teachers from core academic areas in both districts, English and linguistic graduate students, and university faculty with expertise in literacy acquisition and learning, and PBL instruction.

To model PBL structure as much as possible, we intentionally did not design a rigid, fully developed structure for the PD—we left it flexible so the teachers could design their own PBL PD once basic tenets and parameters of the project had been scaffolded. We did choose the initial reading materials about PBL and implementing PBL in secondary education so teachers could gain at least a basic understanding of

PBL and how it works. As part of the grant funding, teachers were given a stipend for additional materials of their choice.

As we will describe in further detail below, each activity that the teachers participated in (workshops, self-directed readings, peer discussions, classroom application and practice, self-assessments, teacher-mentor observations, portfolio creation, and demonstrations of teachers' classroom experiences in implementation) was designed to reflect PBL principles and to enhance literacy awareness. In the first year of the program, 22 teachers participated in the program. Eight of those teachers continued on to be mentors for the second year. In the second year, we followed a similar process in mentor development and expansion into the schools. This paper focuses primarily on the activities and development of the initial group of 22 teachers.

Training

The program began with two summer workshops that included hands-on practice of the two themes of PBL and literacy, led by experts in each of those areas. The teachers began attending monthly meetings in the fall when they began implementing these ideas in their classrooms, essentially learning more about PBL while using PBL. We let the teachers guide the structure of the next components. They decided they wanted to meet once a month for two hours and chose the days, times, and locations. They also selected the meeting content and the topics they would write about in a reflective journal entry before the next meeting. They decided that one or two people at each meeting would present or share what they tried to implement or ask for suggestions for activities, and they created their own schedule, including the length of meetings. At the end of each meeting, they made adjustments based on issues they encountered. For example, the teachers asked each other to take a look at something they designed.

We established parameters and asked them to figure out how to implement the activities, learn more about PBL, and hold each other accountable. In addition, while we selected initial texts, the teachers decided to select discussion leaders for specific readings in those texts and brought additional resources to the meetings. The teachers led the meetings, brought handouts, and shared information about what they and their students had done. To help each other with the PBL process, during these meetings they took turns practicing and getting feedback on their newly designed PBL and literacy activities. This activity provided opportunities for peer collaboration and revision prior to classroom implementation. They had arguments about how much information to give their students and what constituted PBL. For example, after one teacher shared a project idea, another teacher asked, "Why did you give them all this information? It's too much." Early in the process, they wanted expert answers about how to implement PBL effectively, and they asked the facilitators to intervene; however, the facilitators encouraged them to seek the answers from their peers, their resources, and their experiences to further model PBL for the teachers. The teachers were all in different places in the PBL learning process, but they were all able to participate and learn while practicing PBL in their classrooms.

Practice

After working on their PBL and literacy activities during the monthly meetings, the teachers actively practiced these activities in their classrooms, keeping an evidence-based record of their experiences in their reflective journals. These classroom activities were also frequently observed by the program coordinators, who provided additional questions to consider and ideas for further development. At the monthly meetings, the teachers discussed both the ongoing successes and the challenges they encountered. As the teachers continued to develop and practice PBL, they compiled teaching portfolios containing artifacts from their classrooms that showed a correlation between what they learned in the program and the changes that had occurred in their teaching practices, as well as showcasing their students' levels of achievement in literacy in the content areas. Data sources in teacher portfolios included student written work, project descriptions and examples of student products, reading inventories, field observation notes on activities, and teacher reflective journals. The materials for the portfolio were not determined by the workshop administrators; instead they were developed by each group of teachers after discussing how best to "communicate" what was happening with their PBL attempts. The program culminated in a teacher mastery demonstration with both school districts participating. The working portfolios were used by the teachers to create their mastery demonstrations.

Mastery Demonstration

Mastery demonstrations occurred at the final meeting. We asked the teachers to demonstrate their mastery of problem-based literacy instruction, including their ability to apply PBL in their individual classrooms and their understanding about how this new knowledge would help them solve the literacy issues facing their schools.

Teachers presented activities from their portfolios that best demonstrated the impact of their use of PBL activities with their students throughout the semester. These included formal oral presentations, poster boards, slideshows, video presentations, photographs, handouts, and samples of student work (written, audio, and video). Their peers and the program coordinators assessed the effectiveness of the demonstrations based on the successful completion of the established criteria. These mastery demonstrations provided not only an opportunity for the teachers to share their successes, but also the opportunity to network and problem-solve specifically about implementing PBL and literacy in their classrooms and across school districts.

After the mastery demonstration, the teachers completed a survey to see how their awareness about literacy and PBL changed throughout the program. They also completed self-assessments to determine if there were changes in their beliefs about literacy learning and their abilities to implement problem-based instruction in their classrooms.

Contextualizing Teacher Voices

Our objective in the design of the PBL teacher-mentor program was to create a space where a group of teachers who were committed to improving literacy education could consider the joint challenges of that goal and the goal of implementing PBL in their classrooms. This two-year PD program used PBL recursively as both the methodology for the teachers' PD and as the driving question for their classroom content. We used teacher feedback throughout the process to adapt the program to better meet their needs.

Teacher Voices in the Beginning

Before joining the program, secondary teachers submitted answers to several questions about their experience and training with PBL and literacy instruction for LCD groups. Their answers told us what skills or weaknesses they wanted to address, which gave us an indication of how relevant the program objectives were to them.

First, we found that there was a definite need for more literacy instruction in schools and classrooms as well as a need for opportunities to learn more about effective literacy-teaching methods. As one teacher explained:

> Our entire staff is committed to helping reluctant, literacy-challenged learners become more successful students. . . . I encounter many students with highly varying literacy levels. I am always in search of ways to reach my struggling readers and help them succeed within the bounds of curriculum guidelines . . . . An obstacle faced by many of our teachers is a lack of knowledge on how to help our struggling learners improve their basic skills as a fully integrated part of the course curriculum. Literacy skills, especially, have proven to be difficult to overcome. Our staff often expresses frustration over "losing" students because the teachers feel unable to provide the literacy help so many of our students need. . . . The teachers are very receptive to becoming more proficient at helping their students improve literacy skills because the teachers are fully aware of how important it is in today's technology-driven job market.

The teachers also argued that their students needed more authentic student-centered instructions, which they believed PBL would provide. For instance, one teacher wrote that PBL is exactly what her students need:

> In my classroom, I see many students who are disinterested with school and learning. They want to know how this is relevant to them and why they have to learn the materials. These learners are crying out for more PBL that they can apply to their own lives. I would love to learn more ways I can implement it in my classroom and at my school.

Other teachers noted that cross-curricular communication was needed: "As a first-year teacher, I value the importance of working with other teachers to strengthen what I do in the classroom."

From the teachers' initial responses, we were able to move forward with the program knowing that we were targeting the issues that were most important to the teachers. The teachers saw this opportunity as a way to address a real problem they were facing in their classrooms, and they were motivated to work collaboratively to improve classroom experiences for their students.

Ongoing Reflections Through the Year

Reflections during the year were submitted to the workshop facilitators each month to provide us with a mile marker of each teacher's progress and struggles and their classroom accomplishments throughout the program. Teachers were very forthcoming about challenges they were facing in implementing PBL in their classrooms in the reflective writings. Early reflections demonstrated that teacher had difficulties overcoming what they saw as almost insurmountable challenges in the implementation of PBL in their classes—from standardized testing to overcrowding to lack of motivation. For example, the teachers said the following:

Standardized testing constraints. "Traditional assessments often disrupt the learning. All that benchmark tests seem to provide are the percentages of correct answers. They interrupt our learning every 4 weeks."

Overcrowding. "It is also difficult to work in groups with overcrowded classroom where one can barely move because of the number of desks in the room. It takes a lot of creativity to work with the restraints that are put on us."

Lack of student motivation. "Unfortunately, many students don't take ownership of their learning."

As the teachers continued in the program, we noticed an analytical shift in their reflections. They were still acknowledging the issues and challenges they were facing, but they also were problem-solving the challenges and seeking advice from each other during the meetings and through the listserv between meetings:

"My students are having adjustment issues going to a project-based curriculum. It might be helpful to stress the benefits of learning for employment skills."

"I think most teachers create a caring learning environment in spite of overcrowding and lack of funds. I also feel that group work and projects are an asset to students with limited English proficiency and those with learning disabilities. Once the teacher finds these students' strengths, she can group them where they will have an opportunity to shine. Also, working together helps these students' self-esteem as it gives them success and builds relationships with their peers."

"Individual students in my class are able to display [their] uniqueness in presenting solutions to problems."

Teachers also reflected on the ability of PBL to meet students' needs in urban settings. The following quote is taken from a much larger reflection in which the teacher outlined the many ways that a "traditional curriculum" is insensitive to the "informal learning" that students in urban settings must face each day, including peers, crime, lack of supervision in one-parent families, responsibilities for siblings or their own children, and one parent working two or three jobs. This teacher outlines how PBL can help teachers to bridge the gap between the students' lives and the curriculum:

> The ability to solve problems is more than just accumulating knowledge and rules as the curriculum has designed teaching and learning but it is the developments of flexible strategies that help students analyze ambiguous situations to produce meaningful solutions. PBL involved students in teaching by posing a real-life situation connected to the lesson for group of students to solve. Actually, the design of curricula insensitive to the students' daily living had already condemned the values and informal education these students are receiving in their immediate environments, and problem-based learning is a way to amend this problem.

Through the ongoing monthly meetings, teachers were able to gain knowledge of PBL with readings and reflections; however, a more important development was the increase in the trust of the process of PBL, as teachers began to recognize the pushback from students and as they gained an understanding of how PBL applied across disciplines. Because of the PBL frame of the training program, teachers were provided the time and space for authentic application, reflection, and feedback both within and between each school group.

Teacher-Developed PBL Examples

In this section, we include examples of PBL projects that teachers developed for their classrooms. With these examples, we hope to demonstrate the wide range of levels of knowledge and development that the teachers achieved.*

(*The pronouns used do not necessarily indicate the actual genders of the teachers.)

Teacher Example #1: Buying a Car. In our reflections about this example, we learned that to understand exactly what PBL is and how to use it, teachers who are new to PBL need to take time to learn about it, apply it in the classroom (perhaps a little at a time), and reflect on the process and the results so they can work toward a true PBL model. Regardless of how much instructors read and talked about PBL and how many workshops they attended, until they began implementing it in the classrooms, they did not fully understand the implications of using it (how the classroom is different, what to think about, how to shift from a two-hour lecture to a PBL experience, etc.). Even after several monthly meetings, many readings, and several days of workshops, this teacher designed a "PBL" project with primarily individual work for the students.

Setting

This PBL project was designed for a 9th- and 10th-grade algebra 1 class. The math teacher reported a relatively small but diverse group of students with behavioral and cultural problems. Initially, this instructor was reticent to design PBL for this class because of the students' lack of motivation and engagement with course content. This teacher openly admitted a lack of experience with PBL—indicating that this project was the first PBL assignment he had ever created.

The Problem

Students weighed various factors (including gas mileage, cost, repair, longevity, incentives, interest rates, etc.) related to the purchase of a car. Three car options were identified and the "product" was to be a presentation to a "significant other" with a recommendation of which car to purchase.

Teacher Reflection

The instructor said they had two class periods, each a two-hour block, to work through the problem. He said that in this time they were "more engaged" in trying to do this work then they had ever been in the typical classes.

Lessons Learned

The instructor reported, "I chose to do them [the projects] individually, but groups would have been better . . . . I would not provide the details so the students could look for the information."

In this initial example, prior to the beginning of the workshops, this teacher self-reported not even knowing what PBL stood for or what "problem-based" meant. This instructor also did not see any way to use PBL in a math class even with the case studies provided, thinking the students in his classroom were not going to participate.

Although the development of the example of buying a car is not novel in an interactive math class, the implementation of this problem in this teacher's classroom represented a great deal of development and growth in his understanding about PBL and literacy issues and how to begin considering these issues in his math class. It was only after the project was completed that the teacher recognized missing collaborative elements and the need for fewer predetermined teacher elements. Additionally, his reflection indicated a growing understanding of how this type of method may help students learn to approach math problems and develop their own literacy in this content area.

Teacher Example #2: Design an Amusement Ride in Space. This teacher came to the PBL process with a different set of ideas and skills than the teacher from the first example and was able to create a problem that not only met the needs of the content class but also better fit the true PBL model. This example demonstrates that not all teachers struggled in the same ways with implementing PBL in their classrooms.

Setting

This PBL project was designed for an 11th- or 12th-grade astronomy class. The course was overenrolled with 34 students from diverse backgrounds. This teacher tried to use this project previously in the class with varying success, depending on students' interest or motivation and on the interaction dynamics in the class. This teacher used the training in PBL throughout the first year of the program to adjust and expand this assignment into a PBL project.

The Problem

All students were part of an international team established to create an amusement park in space. Each group of students was to design one amusement ride from start to finish. The entire class was to design the amusement park.

Teacher Reflection

By applying the PBL principles, this teacher was able to improve the depth and the engagement of the students with this problem. Additional aspects of the design improvements were the conceptual issues that students grappled with, especially weightlessness. Most of the groups designed rides that were adaptations of Earth-based rides, modified for the lack of gravity. However, one group took the weightlessness as the core concept of their ride. The resulting ride was an Escher-like maze with soft-walls and launch pads, which could be completed as a race (for older kids) or simply as a challenge (for younger kids).

Lessons Learned

This teacher reported that the PBL principles helped her to balance establishing guidelines for the project, which not only established the rigor for the students' work, but also allowed them to be exceptionally creative in the execution. She was immensely pleased with the improvements in conceptual understanding demonstrated by the students in their final presentations and demonstrations of their park rides.

This teacher self-reported using problems in her physics and astronomy classes regularly, but also indicated that, due to absenteeism, seldom did a problem cross more than one class period in the blocked schedule (2.5 hours per class). In her previous class, students would do one predetermined portion of the amusement park problem (design a merry-go-round, for example); however, it was contextualized only to physics or to astronomy, and the amusement park was not located in space. Through the development of her PBL knowledge in this program, she adapted and expanded the problem to be located in space and to be conceptually integrated using both physics and astronomy. She also removed the predetermined requirements for type of rides so students determined which rides worked better in space, and so on. She expanded it to cross over several class periods to allow students time to work on it and incorporated a contest to help motivate students to work harder. She still established outcomes for each class period, but the project culminated in a larger, more complex context because of the issues in placing the context in space. She reflected in her journal that because this problem was more complex, the students wanted to attend class and absenteeism was less of an issue. Her students would even stay after school to work on the project.

This example shows that within this PBL model, even instructors with preexisting knowledge about PBL furthered that knowledge and honed that skill by having to collaborate, share, and discuss decisions they made. Teachers at varied levels can all grow through this type of PD program.

Teacher Example #3: Design a Community Center. This example shows that sustained and supported PBL programs can significantly change how a teacher thinks about teaching and learning and her actual classroom practices. This teacher knew that she wanted to "do things differently," but she needed the opportunity to figure out what this meant for her and her students.

Setting

This PBL project was designed during the latter part of the year with an 8th-grade honors English language arts class. The classroom teacher asked the students what problems they saw in their community and if there were any issues that they would like to explore.

The Problem

After brainstorming and discussing possible community issues, the students said they wanted to learn more about poverty in the community and possible solutions. They located and read several articles about families and children, both in the United States and in their area, who were struggling with poverty. They also read a novel that was selected by the teacher about a teenager who was also dealing with the effects of poverty and violence. After exploring these texts, the students decided that they thought that their community would benefit most from a community center, which they wanted to research and design. Once they had basic plans for what to include, they asked the 8th-grade math teacher to join the project so that he could help them design the building. Ultimately, the class designed the facilities and submitted a proposal to the town council.

Teacher Reflection

In this project, the teacher implemented the PBL principles by having the students identify a problem that they wanted to know more about. This encouraged them to take ownership of their learning, and it made the problem more authentic. The students were also allowed to negotiate how they solved the problem by researching and selecting the articles that they read and by choosing a possible solution to the problem. They also determined that the solution needed to be cross-disciplinary, which led to them inviting the math teacher to join their project. The students worked in both their English and math classes, as well as after school, to complete the project.

Lessons Learned

This teacher reported that the PBL principles allowed her to engage her students in a meaningful way. It also led to a project that was cross-disciplinary, which was one of her school's goals. She said that learning about and practicing PBL made her a "different teacher." Previously, she said, "I was completely a worksheet teacher. I didn't want to be, but I wasn't sure what else to do. Now, after this experience, I'll never go back."

As demonstrated by her comments and by observed changes in her classroom, she embraced PBL and was able to apply it effectively in her pedagogy. Ultimately, she was one of the eight teachers who became mentor-teachers in year two of this project.

Teacher Example #4: Space Race. This example from the second year is included to demonstrate how one of the participants from the first year expanded the program to mentor another teacher into the PBL process. In this case, the astronomy teacher from the previous example partnered with a math teacher who had not been part of the project.

Setting

In the second year of this training project, this semester-long project was developed by an 11th–12th-grade astronomy teacher and a 12th-grade math teacher who was not part of the first year of the project. Since the idea for this project began in year one, the school was able to ensure that almost all students in both classes were the same—so that there could be collaboration between the teachers.

The Problem

Each group of students was a racing team for the space race. The goal of the race was to launch from Earth, circle each of the planets in the universe, and return to earth. Students were challenged to identify the various necessary calculations for this race. For instance, they needed to design the ship (including considering materials vs. weight vs. strength), determine the path for their trip, and decide what supplies and crew were needed. In addition, they needed to make a plan for the semester in order to complete the calculations.

Teacher Reflection

The teachers found it challenging to allow so much autonomy for the students, but they reflected that they were impressed with the results. The astronomy teacher talked about listening in on student conversations where they were discussing how far their orbit should be from Jupiter to circle it. Students were engaged with advanced concepts, but applied them very specifically.

Lessons Learned

Collaboration between the two teachers was time consuming. Group dynamics became a greater issue with a semester-long project, even though the project was not the focus each day. Sometimes interventions and development of "group working" skills were necessary.

The first teacher was the particularly knowledgeable teacher who had been using PBL in a teacher-directed way prior to the first year of this PD program. She progressed from there to the amusement park in space the first year, and in the second year, when she was mentoring a math teacher who was not originally part of this group, the two of them together developed a problem that neither had considered.

The teachers gave students much autonomy in solving this problem. Students got so involved in the details that they argued about everything, including materials, location for departure, and even about when the racers would have to leave Earth because the orbits would line up differently. They tried different orders, incorporating the slingshot effect (gravity assist) to get to the next planet most quickly with the least amount of fuel. Because the teachers were open to allowing students to contribute more, they allowed more dynamic complexity, which enabled the students to own the knowledge. All groups used the slingshot theory; however, some groups went further to research the orbits to determine the departure date based on the orbits, demonstrating that there was enough freedom for these students to add components that considered much more complexity and deeper understanding of physics, math, and astronomy and the integration between these content areas.

Using PBL as the model to train the teachers encouraged their individual PBL development. These examples reinforce that, although the teachers did not all achieve advanced PBL skills, they were able to develop along their own individual paths while contributing to the growth and development of the group, just as it would be in a PBL classroom environment with students who have a wide range of abilities.

Program Evaluations

At the end of the program, the teachers answered a set of open-ended evaluative questions regarding what they learned about PBL literacy instruction and how they would use these methods in their classrooms. Responses from the teachers focused on two distinct aspects of the program—their knowledge of PBL and its classroom implementation and their critique of the training program itself.

Classroom practice responses. Overall, the feedback on the teachers' questionnaires indicated that they believed they knew more about PBL and how to implement it successfully in their classrooms in order to better foster environments that promote literacy acquisition in content areas:

"I can apply and experiment in my classroom with strategies, surveys, and new resources. I can also share with my colleagues."

"This program enabled me to step outside my comfort zone and allow students to take ownership of a project."

"This program taught me what PBL means and how to integrate it into the classroom. . . . I believe PBL is a valuable teaching tool when implemented correctly."

"I learned that students can be trained to solve problems without being led to a conclusion."

"I see how very important real-life situations are in the classroom."

"My students are now more accountable for their learning."

"I will use more problems and real-life situations to encourage critical thinking and information literacy."

Responses about the training model. The teachers' feedback on the questionnaires also indicated that they benefited from our PBL program because it provided not only information but also time and support to develop their knowledge and skills in effectively using PBL. Their comments included the following:

"It really helps to hear others' ideas and how they implement them in the classrooms."

"A definite strength of the workshop was the ability to share ideas concerning literacy with educators from different disciplines. This is not a common occurrence."

"Strengths were interaction between teachers, sharing ideas, and helping each other iron out problems."

"Working in an actual group using PBL was helpful. I finally discovered what PBL was!"

"I liked learning by doing PBL."

"The strength was exactly how it was taught, with groups instead of a lecture, actually doing what we were learning."

These types of comments combined with the information from the other sources, including the PBL demonstrations and classroom observations, indicate that the participants learned about literacy instruction, PBL, and creating their own self-sustaining mentoring programs. The teachers implemented the theoretical information from the program into practical applications in their classrooms and collaborated with each other to address the challenges of this implementation. They also focused on improvement through continuous adaptations of their applications of PBL. Many of the teachers attested to the value of the ongoing training and collaboration and the evolution of their ideas over the course of that first year, reinforcing the value of ongoing, practical, pragmatic teacher development programs as an impetus for change in the classroom.

Interpretation

In this program, the teachers valued the design and methodology of the program, which was itself a model of PBL. They gained excellent ideas about implementing the new PBL practices in their multicultural school districts so they would be better able to foster environments that promote literacy acquisition in content areas. We, as facilitators, also gained a more thorough understanding of the PBL process and are now able to envision and incorporate PBL in other areas and in new roles, including in other teacher training and PD programs, corporate training, and our own classroom teaching experiences.

Anyone who works with PBL understands it is not a one-and-done workshop. In order to fully understand how PBL works and how to implement it, sustained practice and focus are critical. In PD programs like this, these teachers are uniquely suited to provide just-in-time classroom-level knowledge to new teachers who did not go through the training.

This project adds to the growing body of research that indicates meaningful change in the classroom comes only with sustained collaborative practice for teachers to develop implementation skills. Using PBL as a meta-structure for PD allowed teachers time, space, and collaboration to gain expertise in PBL knowledge, application, and practice; to both learn PBL and teach with PBL. Curriculum development can be improved by including PBL elements to create a collaborative classroom that fosters exploration and a content-rich environment. Teacher education programs can successfully use PBL to foster teacher-mentor programs like this one, enhancing training by allowing the teachers to collaborate with and mentor each other and bring new teachers into that process.

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